U. S. FOREST SERVICE
RESEARCH NOTE PSW- 154

PACIFIC SOUTHWEST
FOREST & RANGE EXPERIMENT STATION
1967 P.O. Box 245 Berkeley, California 94701

INTERMOUNTAIN STATION
Science File
No. 0.73

# Remote Ignition of Logging Slash . . .

## *napalm grenades successfully tested*

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*ABSTRACT:* Napalm grenades were tested as an aid to remote ignition of logging slash in Douglas-fir clearcut areas. In all cases, the grenades ignited successfully. Ignition proved best in relatively new logging debris about 2 to 5 feet deep. It was less successful in wet fuels. In heavy fuels, the larger grenades provided better ignition than the smaller grenades tested.

*RETRIEVAL TERMS:* slash disposal; interior Douglas-fir; fire use; napalm grenades; fuel hazard reduction; ignitability; aerial transport.

*OXFORD:* 323.3:436--432.16[--U662.14 +187.466+687.3--U662.14]

Ignition of logging slash is usually achieved on clearcut units in the Douglas-fir region by applying a diesel-fed drip torch or a fusee. But often such a technique is unsafe for burning crews because of excessively steep slopes and rolling material. And firing may progress too slowly to obtain the fast area-ignition sometimes necessary to control the behavior of fire on slopes.

In many slash burns, a grenade-type ignition device could be used to great advantage. Thrown by hand into a desired area, such a device could decrease time spent climbing over dense fuels on dangerous slopes and provide the necessary ignition.

### Backfire Grenade

A commercially available grenade, known as the Burnol backfire grenade,[1] shows promise for use in slash burning as well as for other fire control purposes. First field experiments with these grenades were for backfiring in chaparral fuels on Los Padres National Forest, in June 1966. The device consists of gelled or thickened napalm (Burnol) stored in cans of three sizes: 1/2-pint, pint, and quart. A 40-second wire-pull safety fuse is attached to a small burster unit (fig. 1). The bursting charge is small so as to eliminate or reduce fragmentation of the grenade body.

Upon detonation, an exploding 1/2-pint grenade will throw burning napalm over an open circular area about 8 feet in diameter (fig. 2), but the fire that ensues is usually confined to a 3-to 4-foot diameter. The pint- and quart-size grenades cover larger areas--up to a maximum of 20 feet. The gel-like material will burn from 4 to 10 minutes, depending on grenade size, at an approximate burning temperature of 1,400°F. It has a heat content of 28,000 BTU per pound. The grenade handler should allow a minimum of 50 feet between himself and the "live" grenade.

Costs of these specially ordered and manufactured grenades ranged from $1.90 to $2.50, depending on quantity and size.

The burster units are classified as class "C" explosives and should be stored in magazines as are blasting caps. Napalm has been classified by the Transport Safety Office, National Classification Board for Motor Carriers Industry, Washington, D.C., as the equivalent of Petroleum Grease, Class 65.

### Tests in Slash Burning

We tested more than 300 grenades during the 1966 fall burning season on clearcut slash areas on four National

[1] Manufactured by Explosives Engineering Corporation, Pomona, Calif. Trade names and commercial enterprises or products are mentioned solely for information. No endorsement by the U.S. Department of Agriculture is implied.



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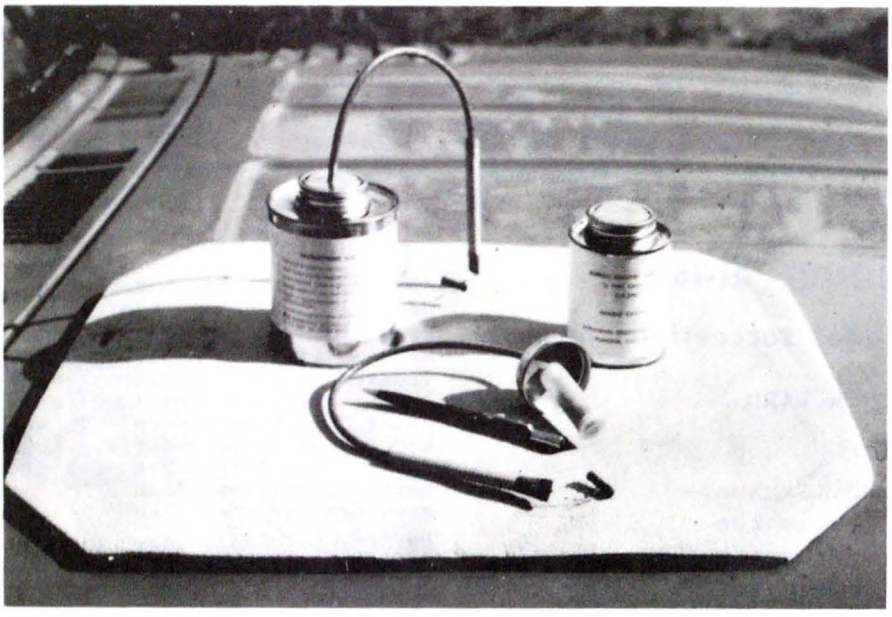


Figure 1.--*Napalm in the grenade is stored in throwable-size cans. The pull-type fuse allows 40 seconds between activation and detonation of the burster unit.*

Forests in Washington, Oregon, and northern California. Fuels on which the grenades were tried consisted of "red" slash--current to 1-year-old logging debris--as well as accumulations of large cull logs and other heavy fuels.

Observations were made to: (a) evaluate the effectiveness of grenades in igniting slash under favorable fall slash burning conditions,[2] and (b) determine safety requirements necessary for safe handling and use.

Grenades in all three sizes provided good slash ignition at least 90 percent of the time. Ignition was best in dense, continuous "red" slash about 2 to 5 feet deep. In wet fuels, slash ignition was difficult, and fire did not spread readily from ignition points. On one clearcut area, after 1.5 inches of rainfall the previous day, the grenades produced burns that resulted only in 20- to 30-foot "holes" in the wet slash.

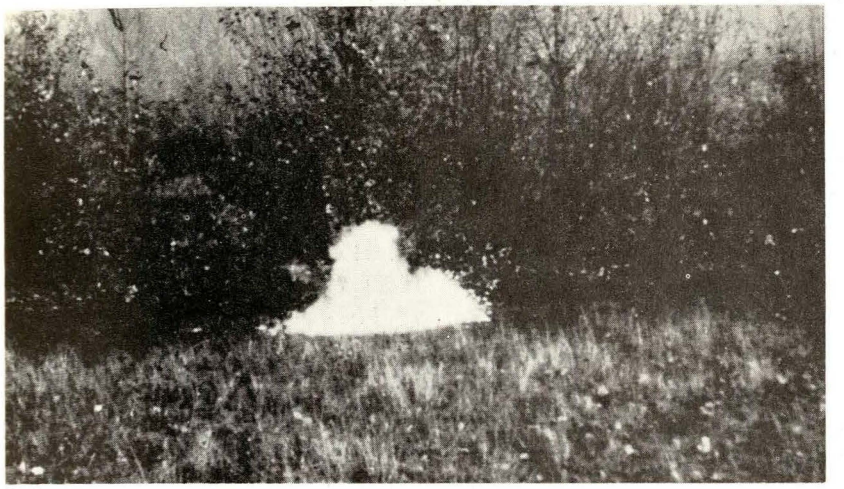
[2]Weather and fuel requirements for burning differ widely among regions. 'Favorable' conditions for slash burning in the Douglas-fir region are described in FSM 5151.22(R-6 Supplement No. 11, September 1966). A few of the grenades were used under less than favorable wet fuel conditions.

In heavy fuels, such as cull log concentrations in landings or draws, ignition was usually difficult to achieve with 1/2-pint grenades. The larger grenades provided better ignition, especially if carefully placed within the fuels.

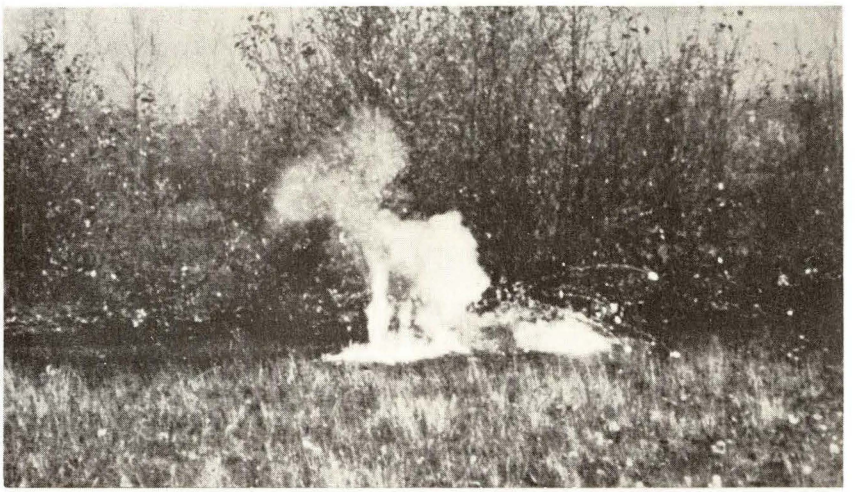
In none of the tests with these devices did we have any misfires or duds. No accidents of any kind occurred.

The tests showed that the greatest advantage of using grenades was in our ability to throw them wherever ignition was desired. This capability appreciably reduced time required for igniting slash. And it contributed to safer working conditions by eliminating much of the ground coverage usually required of slash-burning crews. In addition, the devices proved effective as a means of fast area ignition when the burning crew wanted to buildup heat to redirect the fire.

Although the grenade was not effective on wet slash, it did produce a larger ignition area, and burned considerably longer than any other incendiary device now being used in forest fire control.



A



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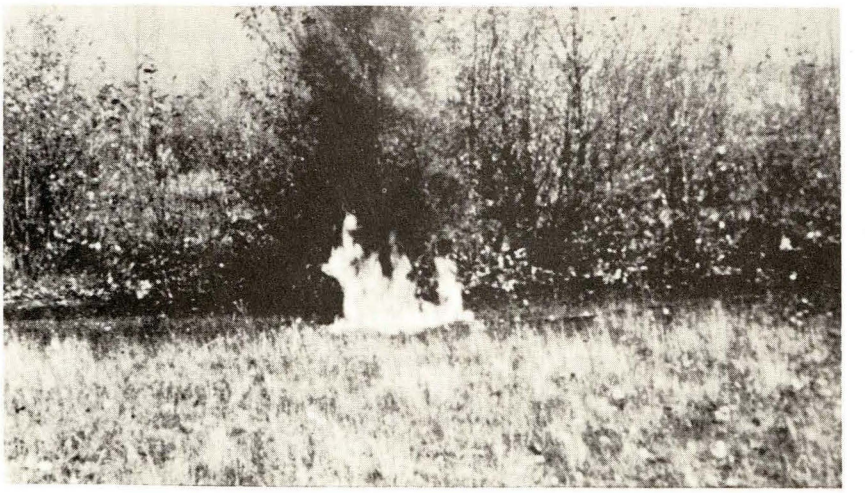

C

Figure 2.--*Fire is dispersed upon detonation of a 1/2-pint grenade:* A, *moment of detonation;* B, *maximum burst area;* C, *size of fire produced (about 3 to 4 feet in diameter). Fire will sustain itself at this size on bare ground for about 5 minutes.*

Fire control personnel while airborne in helicopters may be tempted to drop grenades. Such a practice is forbidden by the U.S. Forest Service for rotary-type aircraft engaged in Forest Service operations.[3] Even if a helicopter were equipped with a pilot-controlled jettisonable grenade container outside the cabin, it is possible there would not be enough time to discard the grenades if the engine failed.

Grenades are hazardous if improperly handled. Extreme care must be exercised in their use. Only persons who are properly trained and supervised should be authorized to use them. When used with the proper precautions, the napalm fire grenade can be a useful tool for remote slash ignition.

[3]Memo (5710) to Regional Forester, Pacific Northwest Region, from Director, Division of Fire Control, U.S. Forest Service, Washington, D.C., July 10, 1967.


## Acknowledgments

We gratefully acknowledge the assistance of Marvin Dodge, California Division of Forestry, on assignment to the U.S. Forest Service, Riverside, Calif., who made initial contacts with the manufacturer and provided helpful suggestions on use of grenades; and personnel from the Six Rivers, Umpqua, Willamette, and Gifford Pinchot National Forests and of the Bohemia Lumber Company, Culp Creek, Oregon.



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